CLAIMS

WHAT IS CLAIMED IS:

1.   A device for determining sugar content of an agricultural product while being harvested, comprising:

a sample preparation mechanism for attachment to a harvester/defoliator and for use with a received agricultural product during harvesting to create an exposed sample of the agricultural product;

an illumination chamber for radiating the exposed sample of the agricultural product;

a sensor head for receiving radiation from the exposed sample of the agricultural product;

a spectrometer, coupled to the sensor, for converting the radiation into a corresponding spectral signal; and

a computer, coupled to the spectrometer, for receiving the spectral signal and for processing the spectral signal to determine an indication of sugar content of the agricultural product.

2.   The device of claim 1 wherein the sample preparation mechanism includes a cutting apparatus for cutting a cross-section of the agricultural product to create the sample.

3.   The device of claim 2 wherein the sensor head receives the radiation reflected from the sample.

4.   The device of claim 1 wherein the sensor head includes:

an enclosure;

a fiber optic cable coupled to the enclosure; and

one or more lenses contained within the enclosure for transmitting the radiation onto the fiber optic cable.

5.   The device of claim 4 wherein the one or more lenses include:

a collimating lens attached to the fiber optic cable; and

one or more optical lenses for focusing the radiation onto the collimating lens.

6.   The device of claim 4, further including a lens holder for mounting the one or more lenses within the enclosure.

7.   The device of claim 1 wherein the illumination chamber includes:

an enclosure;

a light source within the enclosure; and

a light outlet hole on the enclosure for passing light from the light source for radiating the exposed sample.

8.   The device of claim 7 wherein the illumination chamber further includes a ventilation mechanism to reduce heat build-up in the illumination chamber.

9.   A method for determining sugar content of an agricultural product while being harvested, comprising:

preparing a sample of a received agricultural product during harvesting to create an exposed

sample of the agricultural product;

radiating the exposed sample of the agricultural product;

receiving radiation from the exposed sample of the agricultural product;

converting the radiation into a corresponding spectral signal; and

receiving the spectral signal and processing the spectral signal to determine an indication of

sugar content of the agricultural product.

10.   The method of claim 9 wherein the sample preparation step includes cutting a cross-section of

the agricultural product to create the sample.

11.   The method of claim 10 wherein the receiving radiation step includes receiving the radiation

reflected from the sample.

12.   The method of claim 9 wherein the receiving radiation step includes using one or more lenses to

focus the received radiation onto a fiber optic cable.

13.   A method of on-the-go sampling at intervals within a field containing a plurality of agricultural

products to determine sugar content among the agricultural products, comprising:

preparing a sample of a plurality of received agricultural products at particular intervals in a field

during harvesting to create an exposed sample of each of the agricultural products at particular intervals;

radiating the exposed sample of the agricultural product;

receiving radiation from the exposed sample of the agricultural product;

converting the radiation into a corresponding spectral signal;

receiving the spectral signal and processing the spectral signal to determine an indication of

sugar content of the agricultural product; and

recording the determination of the sugar content for each of the plurality of agricultural

products.

14.   The method of claim 13, further including detecting a location of the agricultural product using

an electronic detector.

15.   The method of claim 14, further including using an output of the electronic detector for selecting

the agricultural product to be sampled and synchronizing a sample preparation mechanism for preparing

the sample of the plurality of received agricultural products.

16.   The method of claim 13 wherein the sample preparation step includes cutting a cross-section of

the agricultural product to create the sample.

17.   The method of claim 16 wherein the receiving radiation step includes receiving the radiation

reflected from the sample.

18.   The method of claim 13 wherein the receiving radiation step includes using one or more lenses

to focus the received radiation onto a fiber optic cable.

19.   A method for processing a spectral signal to predict sugar content of an agricultural product, comprising:

receiving a light signal from an agricultural product;

converting the light signal into a spectral signal;

digitizing the spectral signal to produce a plurality of data points; and

processing the data points using dark signal values and a reference signal value to produce a plurality of normalized data points, the normalized data points having values related to sugar content of the agricultural product, and wherein the reference signal value is related to a magnitude at one or more wavelengths of the spectral signal.

20.   The method of claim 19 wherein the processing step includes using as the reference signal value an original or a derived magnitude at one or more wavelengths of the spectral signal.

21.   The method of claim 19 wherein the receiving step includes receiving the light signal reflected from the agricultural product.

22.   The method of claim 19, further including reducing the plurality of normalized data points.

23.   The method of claim 19 wherein the processing step includes using as the reference signal value a value related to original or derived magnitudes at a plurality of wavelengths of the spectral signal.

24.   The method of claim 19 wherein the processing step includes using as the reference signal value an average magnitude value of a range of magnitude values within a pair of wavelengths centered around a reference wavelength.

25.   The method of claim 19 wherein the processing step includes using, as the reference signal value, a value derived from a set of the data points using a mathematical function.

26.   The method of claim 19, further including predicting sugar content of the agricultural product using the plurality of normalized data points.

27.   The method of claim 26, further including:

receiving geographical coordinates corresponding with a geographical location of the agricultural product; and

associating the geographical coordinates with the predicted sugar content of the agricultural product.

28.   The method of claim 19, further including:

receiving a plurality of geographical coordinates corresponding with geographical locations of a plurality of agricultural products for which sugar contents are predicted using the method; and

associating the plurality of geographical coordinates with the predicted sugar contents of the plurality of agricultural products.

29.   The method of claim 28, further including generating a map of the sugar contents of the

agricultural products using the plurality of geographical coordinates and the associated predicted sugar

contents.

30.   The method of claim 29 wherein the generating step includes generating a grid map.

31.   The method of claim 29 wherein the generating step includes generating a contour map.

32.   A method for processing a spectral signal to predict sugar content of an agricultural product,

comprising:

        receiving a light signal from an agricultural product;

        converting the light signal into a spectral signal;

        digitizing the spectral signal to produce a plurality of data points; and

        processing the data points using dark signal values and a reference signal value, eliminating the

use of a spectral signature of a separate physical standard, to produce a plurality of normalized data

points, the normalized data points having values related to sugar content of the agricultural product.

33.   A portable apparatus for use in determining a constituent content of an agricultural product,

comprising:

        a sample holder for holding a sample of the agricultural product;

        an illumination chamber for radiating the sample while in the sample holder;

        a sensor head for receiving reflected radiation from the sample; and

a portable housing for containing the illumination chamber and the sensor, and for accommodating the sample holder.

34.   The apparatus of claim 33 wherein the housing includes a fiber optic cable slot for accommodating a fiber optic cable for transmitting a light signal, corresponding to the received reflected radiation, from the sensor head to an external spectrometer and computer.

35.   The apparatus of claim 33, further including a handle attached to an exterior of the housing.

36.   The apparatus of claim 33 wherein the sample holder includes:

an arm;

a supporting plate attached to the arm; and

an anchoring mechanism attached to the supporting plate for holding the sample of the agricultural product.

37.   The apparatus of claim 36 wherein a surface of the supporting plate has a color providing a low or minimum reflectance from surrounding areas on the surface not covered by the agricultural product sample.

38.   A method for processing a spectral signal to predict sugar content of an agricultural product, comprising:

preparing a sample of a received agricultural product during harvesting to create an exposed

sample of the agricultural product;

radiating the exposed sample of the agricultural product;

receiving radiation from the exposed sample of the agricultural product;

converting the radiation into a corresponding spectral signal;

receiving the spectral signal and processing the spectral signal to determine an indication of

sugar content of the agricultural product; and

associating the indication of the sugar content with a particular location of the agricultural

product.

39.   The method of claim 38 wherein the associating step includes associating the indication of the

sugar content with a field location of the agricultural product.

40.   The method of claim 38 wherein the associating step includes associating the indication of the

sugar content with a harvesting batch of the agricultural product.